EGGS AND EARLY DEVELOPMENT OF TOR MAHSEER FISH[1]

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(With four text-figures)

Tor tor (Ham.), normally occurring in the rivers of northern India has been introduced into the Walwhan lake near Lonavala (Dist. Pune, Maharashtra). It was bred artificially by stripping for the first time and its eggs and larval stages are described and compared with those of *T. khudree* (Sykes).

Mahseers being the most important group of sport fishes of India and having been threatened with severe decline in their fishery, the National Commission on Agriculture (Fisheries Section) felt that the biological information available to date was not sufficient and recommended (1976) "extensive survey and detailed ecological and biological investigations". Sporadic efforts to study larval development had commenced with Nazir Ahmed (1948) in the case of the Assamese Copper Mahseer, *Barbus* (*Lissocheilus*) *hexagonolepis* (McClelland) (now *Acrossocheilus hexagonolepis*). David (1953) described the early fry of *Tor mosal mahanadicus* collected from Mahanadi river and Desai (1972 and 1973) studied the biology and early post larval stages of *Tor tor* (Ham.) and *T. putitora* (Ham.) collected from Narmada river and Chaturvedi (1976) investigated the spawning biology of Tor Mahseer of the Udaipur lakes and streams. Kulkarni (1971) and Tripathi (1978) dealt with artificial fertilisation of eggs, embryonic development and larval stages of *T. khudree* (Sykes) and *T. putitora* (Ham.) respectively. However, fully matured eggs, their development and early hatchlings or larval stages of *T. tor* (with known parentage) have not so far been described by anybody. The present write-up is intended to fill this lacuna with the help of description of eggs and early developmental stages of *T. tor* grown in one of the Hydel lakes of the Tata Electric Companies at Lonavala, District Pune.

T. tor (Ham.) has not, so far, been reported from any waters south of Tapi river (Tapti); but the fish being largely a herbivorous form (Karamchandani *et al.* 1967) and being good as a sport fish, its fingerlings were brought from River Narmada near Hoshangabad (Madhya Pradesh) in November 1973 and released into Walwhan lake at Lonavala, where they thrived and attained a total length of 540 mm (Standard length 445 mm) and weight of 1.75 kg by July 1978. They were marked by comparatively slim body form, short head and distinctly orange-yellow caudal and other fins, as against the blue coloured caudal, slate coloured other fins and deeper body of *T. khudree*. Efforts were, thereafter, made to breed, *T. tor* by the artificial method of stripping, as was done regularly in the case of *T. khudree* at that lake. On August 23, 1978 a ripe female of almost the same aforesaid length was caught and stripped. It yielded a first batch of 6000 eggs, which were cross-fertilised with milt from a specimen of *T. khudree*. The second effort, after half an hour, yielded only 400 ripe eggs and these were fertilised with milt *T. tor* which was reared in a

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pond in the adjoining farm. Both eggs thrived satisfactorily. Dissection of the female yielded another cluster of 10,800 unripe eggs.

Collection of 17,200 eggs from a female of 540 mm only partially corroborates the estimate of fecundity made by Desai (op. cit) namely 7000 to 1,01,600 eggs from females of size range of 283 to 750 mm in three bursts of spawning. Chaturvedi (1976) estimated fecundity of 78, 340 ova for a fish of 546 mm total length. But in the present case, the first batch of 6400 ripe eggs was laid during stripping and the remaining ones which were unripe, were probably intended for the next spawning bursts as presumed by that author. Moreover, in this case possibility of extrusion and loss of some ripe and oozing eggs at the time of entanglement in the nets before the fish was handled, cannot be ruled out. Further, the size of the fish is outside the size range of 340-380 mm for first maturity; but whether it was second or third spawning, could not be ascertained.

Eggs. The diameter of the eggs immediately on stripping was 2.3 mm and they absorbed comparatively very little water like that of the eggs of *T. khudree;* neverthless on fertilisation and absorption of water, they reached a diameter was 2.8 mm. The colour of the eggs was pale lemon-yellow, and resembled the light coloured egg variety of *T. khudree* (Kulkarni 1971). Possibility of brown or deeper coloured variety of eggs could not, however, be ascertained as eggs of only one female were available. The eggs were heavy, demersal and full of yolk and resembled the eggs of *T. khudree* in all respects except a small difference in diameter, those of the latter being slightly larger (3.2 mm); Desai (op. cit.) mentioned size of ovarian eggs of *T. tor* as varying from 1.0 to 2.22 mm and 'orange coloured'. The variation in size and colour may be due to the fact that they were 'ovarian', i.e. yet to pass through the final stage of maturation necessary for proper fertilisation. The perivitel line space in the fertilised eggs is slightly narrower than in *T. khudree* and is much smaller than found in the case of Catla, Rohu or Mrigal. Other particulars of the embryonic development of the larva within the egg capsule are almost of the same nature as that of *T. khudree* (vide Kulkarni op. cit.) About two hours before hatching out, the tubular heart of the embryo was seen pulsating rhythmically; the blood capsules were also seen in the vessels but they appeared almost colourless. Auditory sacs with otoliths and fully developed eyes were visible but the latter were without much pigment except minute melanic dots on the peripheral ring. Pectoral fin buds were also discernible. The first egg hatched after 76 hours but the remaining eggs started hatching out after 79 to 85 hours; a few lagging behind even up to next day. Leaving aside the extremes, the average hatching period can be said to be 82 hours in water temperature of about 24° C.

Newly hatched larva. The earliest hatchling or the newly hatched larva is 9 mm in total length, with a long prominent yolk sac, a protruding head and a thin inconspicuous tail. The eyes have a clear outline but the pigment is not very dark. Rudiments of mouth can be seen, though the jaws are not clear. The pulsating heart is still visible through the transparent overlapping tissues but the blood corpuscles are only faintly reddish. Some of the blood vessels can be traced even posterior to the yolk sac, right up to the caudal portion. The yolk sac being large and yellow in colour is quite distinctive and measures 5.7 mm in length. It is bilobed, the anterior one being more rounded than the posterior one which is rather narrow in width and elongated as

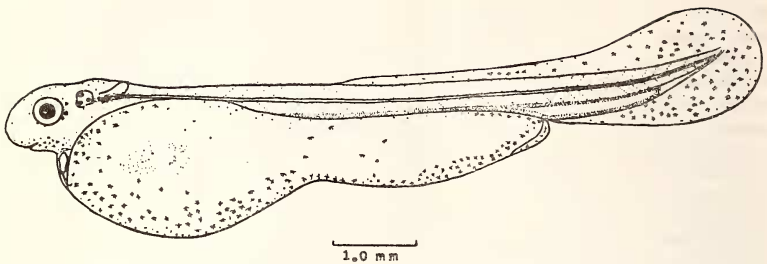

Fig. 1. First day hatching of *T. tor* (Ham.)

seen in Fig. 1; but both lobes are almost equal in length. The dorsal finfold starts slightly anterior to the midpoint of the total length, and continues over the caudal end and terminates near the posterior end of the yolk sac at the expected position of the anal opening. The pectoral fin is small and seen fluttering but no finrays are discernible in it.

The larva, though smaller than that of *T. khudree* appears to be more developed than the latter. The myotomes and some blood vessels are clearly seen. The larva, however, manifests the same behaviour of remaining quiescent and lying on its side at the bottom of the hatching tray. It exhibited jerky movements intermittently and vibrated its tail when slightly disturbed.

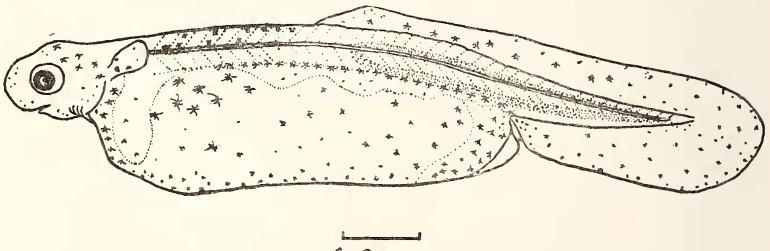

Fig. 2. Two day old hatching of *T. tor* (Ham.)

Two day hatchling: Total length attained 10 mm (Fig. 2). Although the increase in length was nominal, the larva looked much fatter and stouter and continued to remain quiescent, lying on sides and moving vigorously at intervals. The eyes have now become distinctly black with a golden ring when seen in reflected light. Large chromatophores are seen on the anterior portion of the otocyst,

yolk sac and at the base of the pectoral fin. A row of elongated pigment specks are lined between the dorsal portion of the body and the yolk sac. These probably mark the position of the future lateral line scales and are continued in the caudal region. Indented or broken outline of the upper internal margin of the yolk sac which is visible provides a clear indication of the yolk being absorbed within the body. In the mouth area, the lower jaws are developed and are seen twitching at intervals. Gill covers are also seen moving slowly. Anal opening and the anal tube are perceptible. The dorsal fin fold shows a small upward growth indicating the position of the dorsal fin but no trace of fin rays either in this fin or the caudal lobe could be seen. A small vertical fin fold on the posterior part of the yolk sac also develops. Even the anal fin lobe has no fin rays. About 25 body myotomes and 15 post-anal myotomes were clearly visible in the reflected light when tissues were alive.

Three day old hatchling. After three days, i.e. on the fourth day, the larva (Fig. 3) attained a length of only 11.5 mm. The chromatophores at this stage increased all over the body and the head. They are smaller in size but larger in numbers. No finrays are yet discernible in any of the fin lobes. The yolk sac is yet quite prominent but it has changed its outer form by becoming a single continuous sac pointed posteriorly. The finlobe in the pelvic area, i.e. on the posterior part of the yolk sac is reduced in size. The larva which recting its position and trying to swim in normal erect position of a fish but it has still

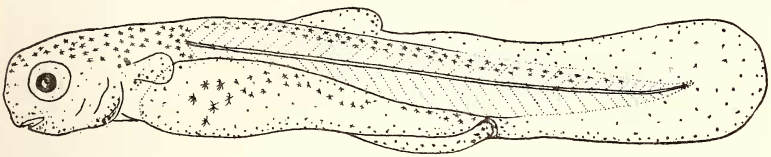

Fig. 3. Three day old hatching of *T. tor* (Ham.)

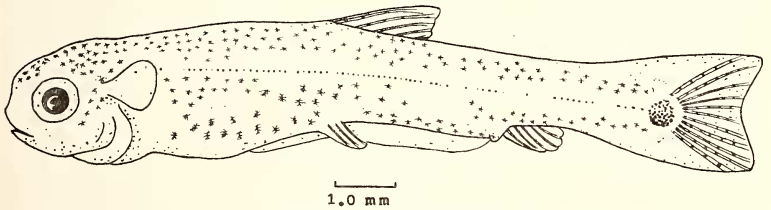

Fig. 4. Ten day old fry of *T. tor* (Ham.)

not reached free swimming stage.

Ten day old hatchling. On the eleventh day, the hatchling has emerged into a tiny fry of about 12.5 mm in total length (fig. 4). The yolk sac has been completely absorbed. Though the length has not increased appreciably during the last five days the development of the external structures has proceeded quite visibly. The body has thickened and the chromatophores have multiplied many fold. They are small on the head, gill cover and the dorsal side of the body all along the length, but large multiradiate chromatophores are seen on the anterior part of the body and below the lateral line. In the caudal region there is a large dark blotch at the base of the caudal fin.

The dorsal fin is clearly demarcated out of the dorsal or the median fin fold, the latter having been completely absorbed up to the caudal lobe where a small vestige remains. In that fin, five rays are seen and the rest are in developing stages. The caudal fin is also demarcated clearly, its terminal end which was rounded in the earlier stage has commenced becoming slightly bifid. Thin fin rays have appeared in the central portion but the growth in the outer fin rays (lower and upper lobes) appears to be affected. The anal fin is also marked out with its fin rays developing. A portion of the fin fold anterior to the anal opening is still persisting and in that region a pair of pelvic fins are making their appearance. The fry at this stage started feeding vigorously on small nauplii of *Artemia* and on small sifted *Moina* and started moving quite actively in the glass tank. However the growth during the last three days appeared to be retarded on account of probable attack of fungus and hence was irregular in some specimens.

Desai (1973) described early stages of *T. tor* out of the collection of post-larvae he made from the open shallow margins of River Narmada. His smallest stage in the collection which he describes as post-larva of *T. tor* measures 8.74 mm whereas the youngest hatchling obtained by me by artificially fertilising the eggs, i.e. where the parentage is known, is 9 mm. The small difference in the total length is negligible and normal but the growth of certain external structures at that length in the case of Desai's early stage, such as demarcation of dorsal fin, the tail becoming forked, yolk sac becoming tapering single lobed and appearance of rudimentary caudal fin rays are not understandable and are not found in the description given here of a 9 mm larva. Development of these structures indicate that his early stage may be a three day old larva, though such larva is 11.5 mm long according to the present observations. As regards myotomes, the number is common in both cases, namely about 40 in each. But his 10.7 mm fry is much more advanced than the 11.5 mm post-larva described here. these differences are hard to explain except the fact that in wild waters where natural stress and competition is high the size of young larvae is smaller than in protected waters.

Fifteen day old fry. After 15 days, the fry was 13.5 mm in length; though it had not progressed noticeably in length, it continued to fatten and looked stouter than before. Even the caudal portion which was thin previously had become thick and prominent with a caudal blotch on it. The chromatophores have become small and thinned out with the result that the fry looked translucent with the development of thin scales. It is olive-white in reflected light. The dorsal fin has eight fin rays, and seven on pelvic fin. The pectoral fin rays have also been developing but only 12 could be counted. The air bladder is seen developing. The vertical fin fold is completely

absorbed except at a small portion anterior to the anal opening.

This stage can be compared favourably with that of the 12.5 mm stage of Desai (op. cit.) except that caudal blotch is wider and more prominent in the present observation.

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